

WHAT IS CLAIMED IS:

1 1. A method for annealing a semiconductor substrate, the method
2 comprising:
3 turning on at least one heat source;
4 heating a semiconductor substrate in a chamber;
5 turning off the at least one heat source;
6 cooling the semiconductor substrate in the chamber;
7 wherein
8 the heating a semiconductor substrate includes raising a temperature of
9 the semiconductor substrate from a first temperature value to a second temperature value;
10 the cooling the semiconductor substrate includes lowering the
11 temperature of the semiconductor substrate from the second temperature value to a third
12 temperature value;
13 the heating a semiconductor substrate includes absorbing an energy
14 from the at least one heat source by the semiconductor substrate;
15 the cooling the semiconductor substrate includes flowing a first gas in
16 a vicinity of at least one wall of the chamber, flowing a second gas in a vicinity of the at least
17 one heat source, and flowing a third gas in a vicinity of the semiconductor substrate;
18 a first temperature of the first gas is lower than the second temperature
19 value;
20 a second temperature of the second gas is lower than the second
21 temperature value;
22 a third temperature of the third gas is lower than the second
23 temperature value.
24

1 2. The method of claim 1 wherein the first temperature, the second
2 temperature, and the third temperature each is lower than the third temperature value.

1 3. The method of claim 2 wherein the first temperature, the second
2 temperature, and the third temperature each equals -10°C.

1 4. The method of claim 1 wherein the first gas, the second gas, and the
2 third gas each comprise at least one selected from a group consisting of nitrogen and helium.

1 5. The method of claim 1, the method further comprising maintaining the
2 temperature of the semiconductor substrate at the second temperature value.

1 6. The method of claim 1 wherein the semiconductor substrate comprises
2 a source region and a drain region, the source region including a source LDD region, the
3 drain region including a drain LDD region.

1 7. A method for annealing a semiconductor substrate, the method
2 comprising:
3 heating a semiconductor substrate in a chamber;
4 cooling the semiconductor substrate in the chamber;
5 wherein
6 the heating a semiconductor substrate includes raising a temperature of
7 the semiconductor substrate from a first temperature value to a second temperature value;
8 the cooling the semiconductor substrate includes lowering the
9 temperature of the semiconductor substrate from the second temperature value to a third
10 temperature value;
11 the heating a semiconductor substrate includes absorbing an energy
12 from at least one heat source by the semiconductor substrate;
13 the cooling the semiconductor substrate includes flowing a first gas in
14 a vicinity of at least one wall of the chamber, flowing a second gas in a vicinity of the at least
15 one heat source, and flowing a third gas in a vicinity of the semiconductor substrate;
16 a first temperature of the first gas is lower than the third temperature
17 value;
18 a second temperature of the second gas is lower than the third
19 temperature value;
20 a third temperature of the third gas is lower than the third temperature
21 value.

1 8. The method of claim 7 wherein the first temperature, the second
2 temperature, and the third temperature each equals -10°C.

1 9. The method of claim 7 wherein the first gas, the second gas, and the
2 third gas each comprise at least one selected from a group consisting of nitrogen and helium.

1 10. The method of claim 7, the method further comprising maintaining the
2 temperature of the semiconductor substrate at the second temperature value.

1 11. The method of claim 7 wherein the semiconductor substrate comprises
2 a source region and a drain region, the source region including a source LDD region, the
3 drain region including a drain LDD region.

1 12. A method for annealing a semiconductor substrate, the method
2 comprising:
3 heating a semiconductor substrate in a chamber;
4 cooling the semiconductor substrate in the chamber;
5 wherein
6 the heating a semiconductor substrate includes raising a temperature of
7 the semiconductor substrate from a first temperature value to a second temperature value;
8 the cooling the semiconductor substrate includes lowering the
9 temperature of the semiconductor substrate from the second temperature value to a third
10 temperature value;
11 the heating a semiconductor substrate includes absorbing an energy
12 from at least one lamp by the semiconductor substrate;
13 the cooling the semiconductor substrate includes flowing a first gas in
14 a vicinity of the at least one lamp, and flowing a second gas in a vicinity of the
15 semiconductor substrate;
16 a first temperature of the first gas is lower than the third temperature
17 value;
18 a second temperature of the second gas is lower than the third
19 temperature value.

1 13. The method of claim 12 wherein the first temperature and the second
2 temperature each equals -10°C.

1 14. The method of claim 12 wherein the first gas, the second gas, and the
2 third gas each comprise at least one selected from a group consisting of nitrogen and helium.

1 15. A method for annealing a semiconductor substrate, the method
2 comprising:

3 turning on at least one heat source;
4 heating a semiconductor substrate in a chamber, the semiconductor substrate
5 including a source region and a drain region, the source region including a source LDD
6 region, the drain region including a drain LDD region;
7 turning off the at least one heat source;
8 cooling the semiconductor substrate in the chamber;
9 wherein
10 the heating a semiconductor substrate includes raising a temperature of
11 the semiconductor substrate from a first temperature value to a second temperature value;
12 the cooling the semiconductor substrate includes lowering the
13 temperature of the semiconductor substrate from the second temperature value to a third
14 temperature value;
15 the heating a semiconductor substrate includes absorbing an energy
16 from the at least one heat source by the semiconductor substrate;
17 the cooling the semiconductor substrate includes flowing a first gas in
18 a vicinity of at least one wall of the chamber, flowing a second gas in a vicinity of the at least
19 one heat source, and flowing a third gas in a vicinity of the semiconductor substrate;
20 a first temperature of the first gas is lower than the second temperature
21 value;
22 a second temperature of the second gas is lower than the second
23 temperature value;
24 a third temperature of the third gas is lower than the second
25 temperature value.

1 16. The method of claim 15 wherein the first temperature, the second
2 temperature, and the third temperature each is lower than the third temperature value.

1 17. The method of claim 16 wherein the first temperature, the second
2 temperature, and the third temperature each equals -10°C.

1 18. The method of claim 15 wherein the first gas, the second gas, and the
2 third gas each comprise at least one selected from a group consisting of nitrogen and helium.

1 19. The method of claim 15, the method further comprising maintaining
2 the temperature of the semiconductor substrate at the second temperature value.

1 20. The method of claim 15 wherein the first temperature value equals the
2 third temperature value.